NOTES FROM THE PSYCHOLOGICAL LABORATORY OF CORNELL UNIVERSITY

I. A Compressed Air System for Demonstrational Purposes

By E. G. Boring and W. S. Foster

Gasometers like the Whipple tanks are unsatisfactory sources of compressed air for acoustical apparatus even in lecture-demonstrations. Some laboratories which are equipped for research purposes with a blower-system of compressed air provide an outlet at the lecture-desk. For laboratories which lack such equipment or which, like the Cornell Laboratory, cannot connect the main system with the large lecture-room, the centrifugal type of vacuum-cleaner will be found to constitute a very satisfactory source of compressed air for lecture-demonstrations involving blown bottles, variators, pipes, reed-boxes, *etc.*

In the Cornell Demonstrational Laboratory we have installed the motor and blower of the Frantz Premier vacuum-cleaner. In this machine the fan is connected directly to the motor-armature and operates inside an aluminum casting, to which connection is made by a special "blower attachment." The list-price of the complete machine is $35.00, but the manufacturers (Frantz Premier Co., Cleveland, O.) were kind enough to supply us with the motor, fan, casting, and blower attachment at a considerable reduction.

The motor is suited for either A.C. or D.C., 110 volts. When in operation it makes a good deal of noise. The whole outfit, however, is small; and the noise was muffled by placing the motor in a double-walled box with sawdust between the walls. The outside dimensions of the box are 16 by 16 by 8 inches; the thickness of the walls, 2 to 3 inches. The noise was still further reduced by placing the box in the Demonstrational Laboratory and leading the air by a 1-in. iron pipe to the lecture-desk in the adjoining room. To prevent conduction of vibration along this pipe a short piece of rubber tubing was used as a coupling between pipe and blower attachment. A gate-valve at the lecture-desk regulates the air-pressure, and a push-button behind the desk controls the motor. Beyond the gate-valve a removable set of distributing connections is attached. At the one side of a full-sized T a second T with a separate valve makes possible the combined or independent use of two tonometers, while at the other side of the T seven ⅜-in. gas-cocks, tapped into the 1-in. pipe, supply outlets for blowing variators, bottles, pipes, and whistles.

With this arrangement the pressure maintained is sufficient to operate simultaneously at full intensity almost half the reeds of the large Appunn tonometer (512-1024 vs. by 4 vs. steps). The Galton whistle, piston-whistles, bottles, and variators are easily blown either separately or in combination when connected with the gas-cocks. The tone produced is sensibly constant. Even the addition of two or three variators (which draw a relatively large volume of air) does not materially alter the intensity of the Galton whistle, for which a fairly high pressure is necessary.

We have found that the demonstrations are most durably set up if flexible metal tubing is used to connect the gas-cocks with the smaller apparatus, and if short straight pieces of large-bore rubber tubing connect the large openings of the iron pipe with the tonometers. Bends in the rubber tubes leading to the tonometers are avoided by permanent elbows fixed to the vertical intake-openings. A large 1½-in. pipe-flange, bearing a 1½—1-in. reducing ell and a nipple, has been screwed to the bottom of each tonometer over the inlet opening; the length of rubber tubing can thus be slipped directly over the horizontal nipple without bending.

II. Delboeuf Disks and the Kirschmann Photometer

By E. G. Boring

Of the three methods described by Titchener[1] for the experiment on the application of the Method of Equal Sense Distances to brightnesses, the first, as Titchener points out, is mechanically unsatisfactory, and the third, which requires three motors or a triple color-mixer, is often impracticable. The Delboeuf disks of the second method are made by passing black sectors on white cardboard. It is difficult to cut these sectors exactly, and still more difficult to paste them correctly, as they must be perfectly centered and separated by 180° with an error of less than half a degree. If the space order is to be varied, two disks have to be cut. The movable sector can be made to use with both space orders, but must in that case be notched in a way that makes it easily breakable. Both cardboard and black paper are often smudged in pasting. With use the pasted black paper is likely to get shiny, the cardboard dirty, and the sector broken. An accident to any one of these three pieces means the remaking of all three, if the tone of the black and the white is to remain the same. Even when the experiment proper has been successful, it sometimes happens that the student gets the black sample pasted on the Kirschmann photometer in such a way that it does not exactly resemble the black of the disks. In general we have found that every pair of students requires a new set of disks, which take a couple of hours to prepare.

We have therefore substituted in the Cornell Laboratory the method described by Martin[2] for the contrast experiment. We cut disks of three sizes from each of the two gray papers which have been selected as the terminal stimuli. The middle-sized disks are slotted and fitted together; when mounted concentrically on a mixer, with a small disk of the one gray and a large disk of the other, they constitute the variable ring. Space order is reversed by substitution of the other (large and small) disks. The method saves the time required for cutting on the disk-cutter arcs of limited length, for laying out radii at exact angles, and for pasting the paper on the disks; and it avoids the errors arising from poor spacing and centering, and from the frequently non-uniform appearance of a pasted black paper. Moreover, the use of gray papers instead of black and white makes an accurate adjustment of the variable easier; for the total range of

[1] E. B. Titchener, *Experimental Psychology*, II, i, 87-90.
[2] L. J. Martin, *Amer. Jour. Psychol.*, 24, 1913, 33f.